Report for 2003AR50B: Evaluating the Influence of Lake Francis on Phosphorus Concentrations and Transport at the Illinois River

- Conference Proceedings:
  - Soerens, T., 2004, "Phosphorus Loads Upstream (Arkansas) and Downstream (Oklahoma) of Lake Frances: Are Differences Due to Monitoring Program Design, Natural Variation, or the Lake?," National Water Quality Monitoring Council, 2004 National Monitoring Conference, May 17-20, 2004, Chattanooga, TN.

Report Follows

PROBLEM AND RESEARCH OBJECTIVES

Lake Frances is a very small impoundment on the Illinois River that spans the border between Arkansas and Oklahoma. Results of water quality monitoring have shown apparent differences between nutrient concentrations upstream (Arkansas) and downstream (Oklahoma) of the lake. In Oklahoma, results have shown increasing trends in phosphorus loads. The sampling and load calculation are performed by different agencies on the different sides of the state line and monitoring strategies have changed over the years. The goal of this project was to identify the reasons for the differences between the states and to investigate the influence of Lake Frances on phosphorus concentrations and transport.

METHODOLOGY

The study used water sampling, sediment sampling, and historical data to evaluate changes in phosphorus concentrations and loads upstream and downstream of Lake Frances during base flow and surface runoff flow regimes. Water quality samples were taken on ten dates at four locations – upstream and downstream of Lake Frances and in two tributaries. Samples were analyzed at the USDA-ARS-PPPSRU laboratory. Sediment cores were taken at several locations and phosphorus flux was measured in the laboratory. Historical data was obtained from USGS and from published reports by state and federal agencies. Arkansas and Oklahoma newspaper archives were searched for stories related to Lake Frances and conversations were held with Siloam Springs water supply personnel.

PRINCIPAL FINDINGS AND SIGNIFICANCE

Initial results of water sampling show that Lake Frances is a phosphorus sink (higher concentrations upstream than downstream) and a phosphorus source during winter. Sediment sampling showed sediments very rich in phosphorus with high phosphorus exchange rates. Examination of historical discharge data shows no apparent discrepancies between upstream and downstream flows. It appears that differences between upstream and downstream loads are primarily due to the variation and imprecision in determining concentrations and loads and to differences in monitoring program design. These results underscore the need for monitoring programs on both sides of the state border to be consistent and comparable.